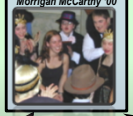
VCS Science:

The goal of the Vermont Commons School Science program is to produce Naturalists. A Naturalist is a scientist who understands the environment and one's place within that system. A Naturalist will be able to use the Scientific Method to identify the keystone questions within a particular system, answer them thoughtfully, and then act upon the new knowledge.
The VCS science curriculum is multidisciplinary, using Ecology and Systems Science to understand the interconnections between Chemistry, Physics, and Biology.
(Peter Goff & Dr. Donna Rizzo (UVM, CEMS) with further contributions by Hans Manske and Ruth Heindel)

Sep 1997, VCS founded

Graduation 1998

'98 Science Award:
Morrigan McCarthy '00



Hans Manske:
In year two, Hans joined VCS. His graduate work in geochemistry perfectly met VCS' need for someone to round out the life-science-dominated department. For the next decade-plus, Hans taught chemistry, geology, and environmental science while helping to define the Vermont Commons School community as we know it today.

Graduation 1999

'99 Science Award:
Asher Burns-Burg '01

Naturalist Certificate:

The Naturalist Certificate recognizes VCS students who have met the goal of the VCS Science curriculum of producing Naturalists, scientists with a fundamental understanding of the scientific method and a personal connection to the natural world. VCS students who go above and beyond the traditional science curriculum are awarded this recognition upon graduation.

Minimum certificate requirements are:

- VCS Science GPA of 85%
- The Naturalist Project: An independent project that impacts our local watershed and promotes our Mission.
- Naturalist Tour: An educational walking tour of some part of our watershed that demonstrates the Naturalist's understanding of our native biodiversity and local landscape.

Graduation 2000

'00 Science Award:
Nissa Kauppila '01

Naturalist Certificate:
Matt Brown (2000): The EcoMachine Workshop

Project: **Matt designed and taught a semester-long Research & Service class on EcoMachine design. This class culminated in a workshop run by VCS students for area Vermont High School teachers.**

Tour: **Matt led 20 students, faculty, and community members on a two-hour tour of the Colchester Bog. Matt explained the geologic history and formation of the bog, and explained the life-histories of the rare and endangered species found in this unique and fragile ecosystem.**

Graduation 2001

'01 Science Award:
Matt Brown '01

AP Environmental Science Web-CT course
Peter Goff and VCS AP Environmental Science Course

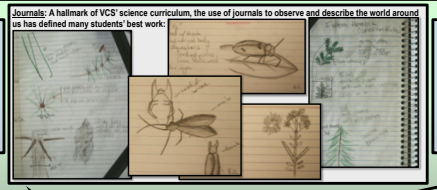
Project: **After receiving a grant from the Collage Board™ in collaboration with Dr. Alan McIntosh (UVM, Rubenstein School of Natural Resources), Peter Goff and several VCS classes designed the laboratory component of an AP Environmental Science course. The labs, written by Goff and Manske, were performed via closed-circuit TV by VCS students. These programs were used by small schools throughout New England who didn't have access to appropriate lab materials, techniques, and/or instructors.**

special acknowledgements to the following students: Emily Alger ('03), Naomi Heindel '03), and Asher Burns-Burg ('01)

Graduation 2002

'02 Science Award:
Ruth Heindel$_{1/3}$ '05

Journals: **A hallmark of VCS' science curriculum, the use of journals to observe and describe the world around us has defined many students' best work.**



Graduation 2003

'03 Science Award:
Ruth Heindel$_{2/3}$ '05

Naturalist Certificate:
Emily Unger (2004): Living Vermont Field Guide

Project: ***Emily researched the history of field journals, as far back as pre-Colombian native Americans, at the University of Vermont. She incorporated the lessons she learned in a field guide of native Vermont flora & fauna, producing a 60-page document which has been used as part of VCS' curriculum.***

Tour: ***Emily led a busload of hikers up Mt. Philo. She described the geologic history of the Champlain Valley, from the days of the Champlain Sea to the current formation of our watershed. During the hike, Emily demonstrated her mastery of field taxonomy by identifying more than 50 species.***

Graduation 2004

'04 Science Award:
Emily Unger$_{1/2}$ '06

Systems Science Learning Project
*Rob Skiff & Peter Goff and multiple Science and R&S classes**

Project: **The SSLP was a joint VCS – Nanjing Normal Institute & University project that ran from 2004-2007. We developed, delivered, & managed curriculum for a 3-year project that teamed VCS students with Chinese students on cooperative system science modeling projects (which included reciprocal travel). While in Vermont, the American & Chinese students presented at a modeling conference (a joint MIT / WPI conference in Worchester run by the Creative Learning Exchange), for UVM professors, local experts/stakeholders, and a research group from Boeing Phantomworks. As a result of this collaboration, Rskiff and PGoff were invited to a Complex Systems in Education conference in Shanghai, China, in 2007 where we presented the results of the project.**

special acknowledgements to the following students: Josh Decatur ('11), Ian Hollyer ('10), Ted Retzloff ('11), and Ruby Russell ('10)

Graduation 2005

'05 Science Award:
Ruth Heindel$_{3/3}$ '05

Graduation 2006

'06 Science Award:
Emily Unger$_{3/2}$ '06

Naturalist Certificate:
Ian Hollyer (2006): Lewis Creek hydrology

Project: ***Ian worked with the VT Agency of Natural Resources, the Lewis Creek Association, and local land-owners as he performed a year-long chemical analysis of one of our local watersheds. By examining the effect of land use on a fragile riparian ecosystem, Ian was able to provide some well-researched management solutions to all stakeholders.***

Tour: ***Ian guided students, teachers, and VCS community members through his study site. He described how important riparian corridors are, why they are important, and how they are impacted by human land use patterns.***

Graduation 2007

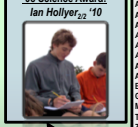
'07 Science Award:
Ian Hollyer$_{1/2}$ '10

Scope & Sequence: **VCS science courses are interdisciplinary, semester-long courses allow students to better integrate content and skills across Biology, Chemistry, and Physics. Ecology and Systems Science provide a common framework across a student's entire VCS science career.**

Grade	Fall Semester	Spring Semester
7th	System Science & Ecology	Systems Science & Biology
8th	The Living Vermont	The Geology of Vermont
9th	Chemistry I: Matter & Energy	Biology I: Cellular Biology & Anatomy
10th	Physics I: Mechanics	Biology II: Evolution
11th	Chemistry II: Stochiometry	Physics II: Light & Electricity
12th	Senior Electives I	Senior Electives II

Graduation 2008

'08 Science Award:
Ian Hollyer$_{2/2}$ '10



Electives: **During their Senior year, students select among a list of semester- or year-long courses, including:**

Advanced Ecology
Advanced Genetics
Advanced Modeling
AP Biology
AP Environmental Science
AP Physics
Animal Behavior
Applied Chemistry: Food Science
Ecosystem Management
Geophysics
Marine Biology / Oceanography
The Living Vermont II
Zoology

Contract Honors (CH): **10th, 11th, and 12th – graders may select a Contract Honors option for each class.**

Requirements for admission to CH program in Science
Minimum High School science average of 90%.
A contract signed by the students, their parents, and the student's academic advisor.
Once this contract is signed, the student may not withdraw from Contract Honors.

General methodology/pedagogy:
Class and lab will be identical for CH and non-Contract Honors (nCH) students.
Differentiation will come in the form of:

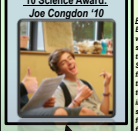
- Significant (in terms of quantity and complexity) additional outside-of-class work.
- The CH work could take the form of regular assignments, long-term projects, presentations, etc..
- Differentiated 'major' tests/exams. During Final Exams, and whenever deemed appropriate by the teacher, CH and nCH students will take different tests, to ensure that the CH students are being evaluated on the additional content.
- CH students may be required to attend additional meetings.

Graduation 2009

'09 Science Award:
Sarah Mueller '12

Graduation 2010

'10 Science Award:
Joe Congdon '10

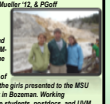


Summer Research: EPSCoR – Genetic Sequencing
Mikela Bourdette '11, Schuyler Cowan '11, Leslie Gadway '12, Leynah McGarghan '11, & PGoff

Project: ***Through Vermont's federal EPSCoR grant program, the VCS team worked in Dr. Sarah Helms-Cahan's DNA sequencing lab to pilot a lab protocol that would be used in Vermont High Schools. The girls collected ants from field sites, isolated their DNA, amplified the DNA (to get enough genetic material to use with the sequencing protocols), and finally learned to enter the information in the national DNA databank to successfully identify the species. Dr. Helms-Cahan brought her team of graduate students to VCS the following fall and with the help of Leslie (pictured), VCS students were the first to attempt (successfully) the DNA sequencing protocol.***

Summer Research: NSF-funded Whirling Disease Project
Shana Wolfstein '11, Sarah Mueller '12, & PGoff

Project: ***Through two National Science Foundation grants totaling $30,000, PGoff was able to secure positions for himself and two VCS students to take part in a joint UVM-Montana State University project to examine a deadly trout-disease; Whirling Disease. The VCS team developed a STELLA model of the complex 2-host disease system which the girls presented to the MSU Ecology faculty during our field & lab work in Bozeman. Working side-by-side with undergraduates, graduate students, postdocs, and UVM and MSU faculty, the VCS team took part in both field and lab work. Working with UVM professors Dr. Donna Rizzo (CEMS) on the modeling component and Dr. Lori Stevens (Bio) on the genetic-sequencing component of the project, we were also authors on a paper presented by Dr. Rizzo at the American Geophysical Union annual meeting in San Francisco.***



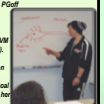
Graduation 2011

'11 Science Award:
Schuyler Cowan '11

Invited Speakers: At the Annual Noyce Foundation Scholar Celebration dinner, Miles Lamberson ('14), Aidan Villani-Holland ('14) & PGoff described the EcoMachine curriculum at VCS.

Summer Research: Artificial Neural Networks
Lex Jackson '12 & PGoff

Project: ***Alexis Jackson was awarded a paid internship in Dr. Donna Rizzo's lab in the Environmental Engineering Department at UVM to research Artificial Neural Networks (ANNs). Lex taught herself the MatLab programming language to build her own pattern-recognition ANN. Over the course of the internship, she created an hour-long presentation with the goal of having Dr. Rizzo co-present the work with her to the Governor's Institute of Vermont Math Academy. However, Lex demonstrated such a strong mastery of the material, that Dr. Rizzo asked her to present the work on her own (which she did, to rave reviews).***



Summer course: Modeling Dynamic Systems (UVM: CE1952E) taught by PGoff & Dr. Donna Rizzo, 2 VCS students enrolled)

Naturalist Certificate:
Ruth Heindel (2006): VCS-achievement

Project: ***Ruth has, and will continue to, live the life of the naturalist as much as anyone ever associated with VCS. Ruth has lived and worked in the Arctic Circle, and left Vermont to begin her Graduate research in Greenland and Antarctica.***

Tour: ***Through Encounter Weeks, R&S classes, and asa full-time VCS faculty member, Ruth truly knows our natural community.***

Invited Speakers: At the Annual Noyce Foundation Scholar Celebration dinner, Chad Edwards-Kuhn ('10), Sarah Mueller ('12) & PGoff described the System Dynamics curriculum at VCS.

Graduation 2012

'12 Science Award:
Nora Hill '15

Summer Research: EPSCoR RACC
Aidan Villani-Holland '14, Nora Hill '15, & PGoff

Project: ***Through Vermont's federal EPSCoR grant program, the VCS team started a year-long research project as part of the Research on Adaptation to Climate Change (RACC) program. Throughout the summer and fall, the team collected stream data at the Huntington River. This data was used to build a STELLA model of the system to be presented at UVM's annual undergraduate research day in the spring of '13.***

Summer course: Modeling Dynamic Systems: Chagas Disease (UVM: CE1952E) taught by PGoff & Dr. Donna Rizzo, 4 VCS students enrolled)

Graduation 2013

Vermont Science Teacher of the Year:
Peter Goff was recognized by VASE (Vermont Academy of Science and Engineering) as the High School teacher of the year, 2012.

New course: Through a grant from the Gates Foundation secured by Heather Moore, the Science (PGoff) and Social Studies (Hillman) departments become the first in the world to teach *The Big History Project* to 8th graders.

'13 Science Award:
? Your name here ?